A Vision for Ethanol in the Transportation Sector

Ron Westby
CEO, Energy Analytics LLC
Former Director of Environmental Policy,
Ford Motor Company

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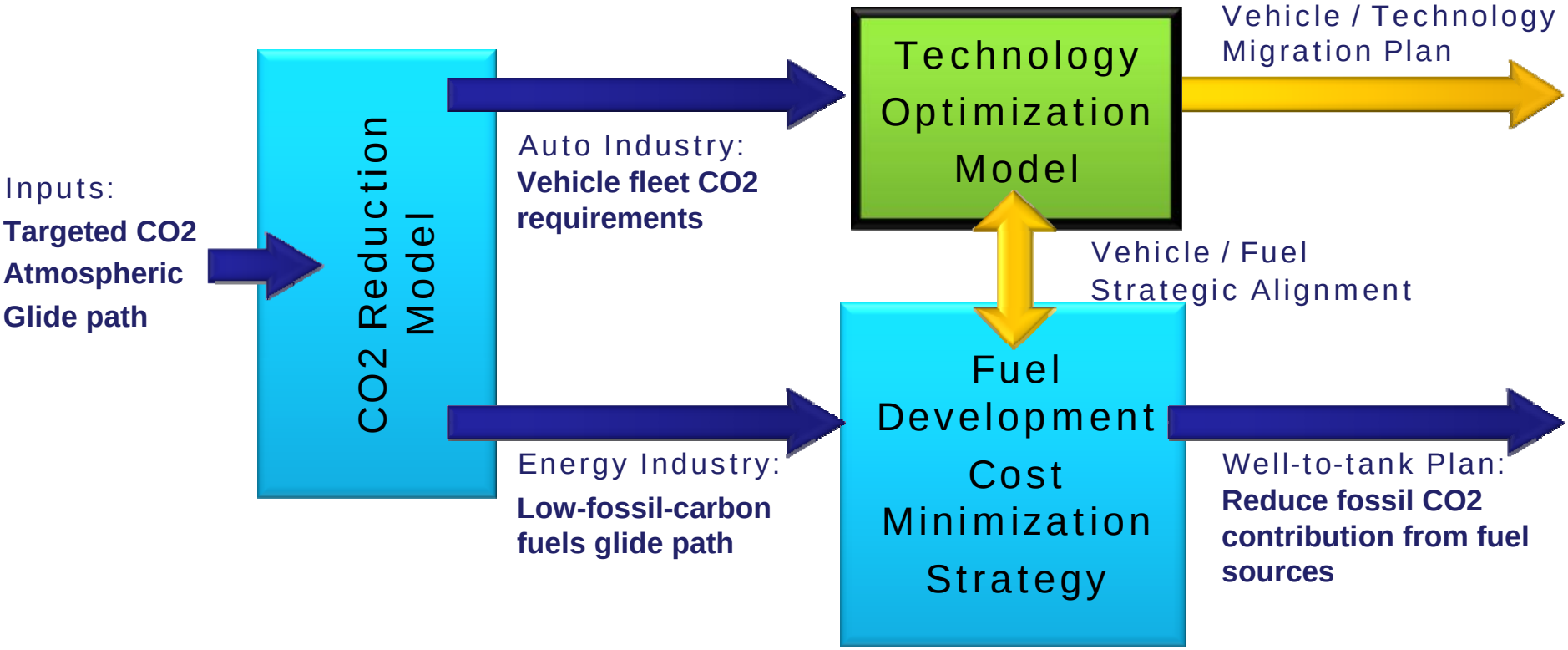
Ford's Sustainability Framework for CO_2 and Technology Migration Development



CO_2 Model to Estimate the Emissions Reduction Requirement of the Light-Duty Vehicle Fleet

Inputs

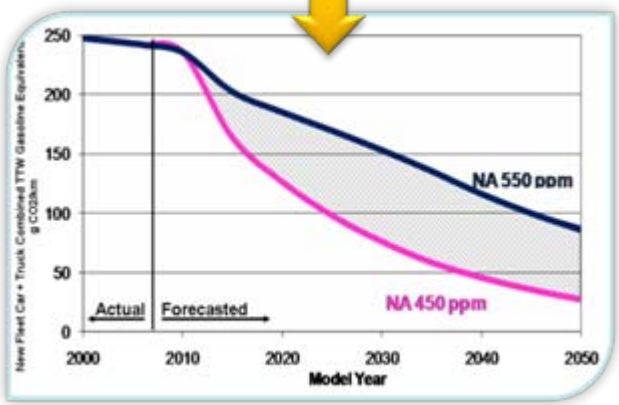
- Sales volume
- Vehicle miles driven
- Vehicle fuel consumption
- Vehicle retirements
- Fuel CO_2 information
- Emission reduction per stabilization trajectory

CO_2 Reduction Model

- Proportionally applies emissions reduction to all sectors and regions
- Factors in things that impact year-over-year emissions output (old / new vehicle mix, bio fuel availability)

Outputs

- "New fleet" targets that are required to move the "overall fleet" glide path in line with the required emissions reduction trajectory



Ford Model to Optimize Technology Migration

Inputs

- Vehicle segmentation
- Performance targets
- Fuel economy targets
- Technologies migration for:
  - Powertrain architecture and technology attributes (gas, diesel, fuel efficiency, torque)
  - Vehicle system technologies
  - Weight reduction actions
  - Cost models

Technology Migration Optimization Model

- A vehicle systems approach to maximizing fuel economy and minimizing cost

- Primary Weight Reduction
- Secondary Weight Reduction
- Aero
- Electrical Loads
- P/T and Driveline Efficiency

Outputs

- Projections for:
  - Fuel economy
  - Performance
  - Costs
- Vehicle and technology glide paths
- Weight reduction actions
- Scenario futuring

Technology Migration Path

2007 | 2012 | 2020 | 2030

Near Term
Begin migration to advanced technology

Mid Term
Full implementation of known technology

Long Term
Volume roll-out of Hybrid technologies and alternative energy sources

Near Term

- Significant number of vehicles with EcoBoost technology
- Dual clutch and 6 speed transmissions replacing 4 and 5 speeds
- Increased hybrid applications
- Increased unibody applications
- Introduction of smaller showroom entries
- Electric power steering 80% - 90%
- Battery management systems 75%
- Aero improvement up to 5%

Mid Term

- Weight reduction of 250 - 750 lbs
- Engine displacement reduction aligned with weight save
- EcoBoost available in nearly all vehicles
- Increased use of hybrids as a percentage of gas engines
- Diesel use as market demands up to 10%
- Additional Aero improvements up to 5%
- EPAS approaching 100% on light-duty

Long Term

- Percentage of internal combustion dependant on renewable fuels
- Volume introduction of HEV, PHEV
- Introduction of BEV and fuel cell vehicles
- Clean electric / hydrogen fuels

Biofuels – Critical for Sustainability

2007 2012 2020 2030

Near Term
Begin migration to advanced technology

Mid Term
Full implementation of known technology

Long Term
Volume roll-out of stretch technologies and alternative energy sources

Near Term

- 1st generation biofuels ramp up to capacity
- Growth of fossil fuel peaks as advanced vehicle technology migrates into the in-use fleet

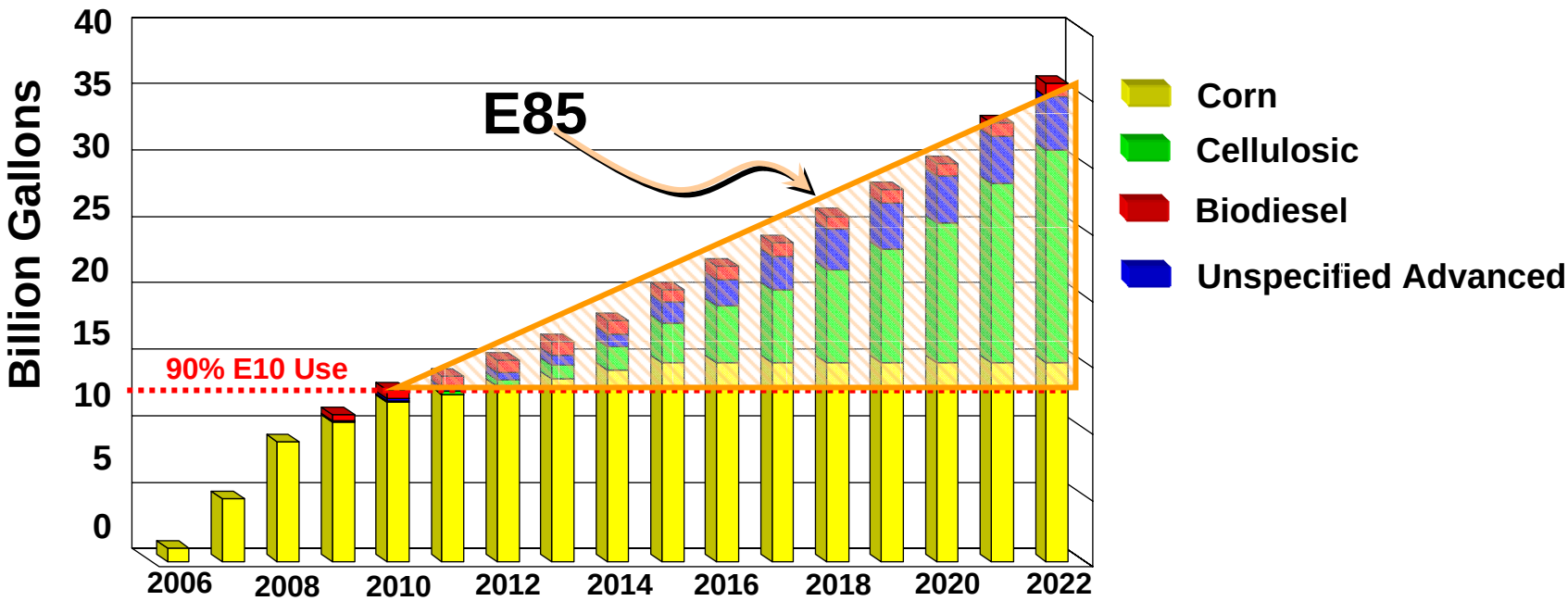
Mid Term

- 2nd generation biofuels become viable
- Total renewable fuel capacity is expanded
- Fleet programs confirm readiness of plug-in HEV and hydrogen vehicles

Long Term

- Renewable fuels are the primary content as fossil fuels ramp down
- Clean alternative fuels (electricity and hydrogen) enable volume applications of plug-in HEVs, H2ICEs, and eventually FCVs

Renewable Fuel Standard Will Require Substantial Expansion of FFVs and E85



- Consuming 36B Gallons Requires FFVs and E85
- E10 Blend Ceiling – Near Term Issue for Ethanol Industry
- Corn-based Ethanol Could Reach 30 Billion Gallons Annually by 2020 Based on Doubled Productivity

Vision: Ethanol Becomes an Alternative Fuel, Not Just a Gasoline Additive

Additive

E10

Fuel: 10 B Gals.
Vehicles: 244 Million
Stations: 164,000

Alternative

E85

Fuel: 100 M Gals.
Vehicles: 7 Million
Stations: 1,700

Issues: Need to increase…

- ↑ Vehicles that can operate on E85
- ↑ Volume of ethanol that is used for E85
- ↑ Number of stations offering E85